BlueSky

A Smoke Modeling Framework

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USDA Forest Service

Atmosphere and Fire Interaction Research and Engineering (AirFIRE) Team

Pacific Wildland Fire Sciences Lab

BlueSky

Smoke Modeling Framework

Integrates all we know about fuels, fire, smoke, and weather into one, centralized system.

National Fire Plan
Managing the Impact of Wildfires on the Communities and the Environment

PNW

AIR FIRE

What can BlueSky do?

- Real-time Smoke Concentration Predictions: Prescribed, Wild, *Agricultural* Fires
- Daily Emission Tracking from Multi-Agency Burn Reporting Systems
- *Quantitative Verification*
- Automated, centralized processing
- Web-access to output products

BlueSky

Focus, Integration, Collaboration

- Provides surface PM2.5 concentrations from wildland fire.
- Aiding burn decisions by allowing for:
  - Multi-Agency Communication (address competition for airshed issues)
  - Dissemination of Information to the Public
  - Aid in Go/No-Go/Go-Slow Burn Decisions
- Integrates existing science and knowledge.
- Collaboration is the foundation.

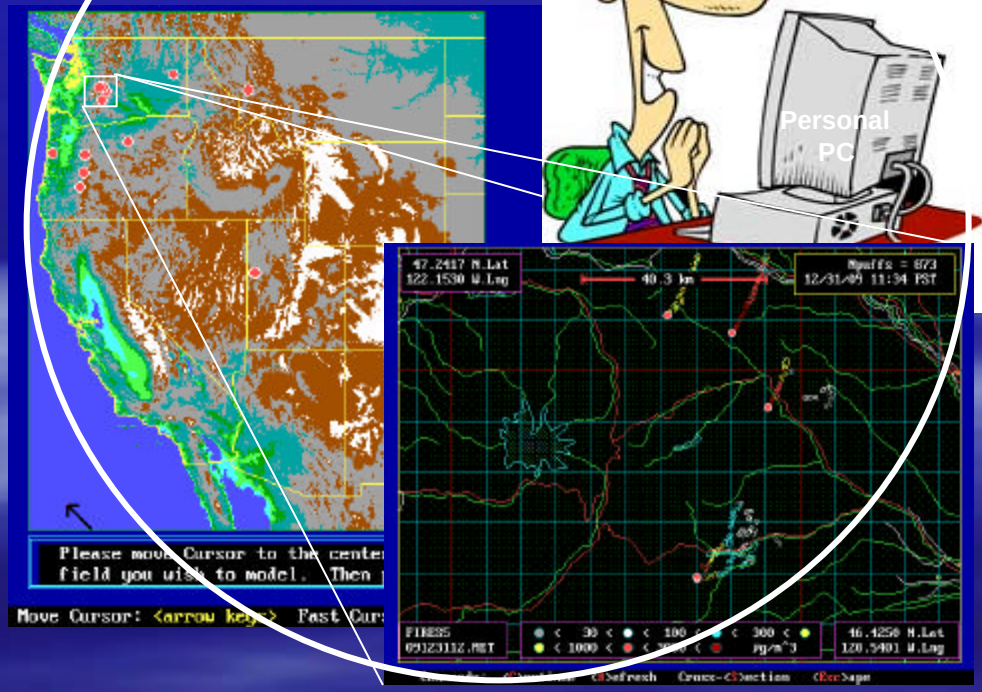
Smoke Predictions

MM5 36-km

MM5 12-km and 4-km

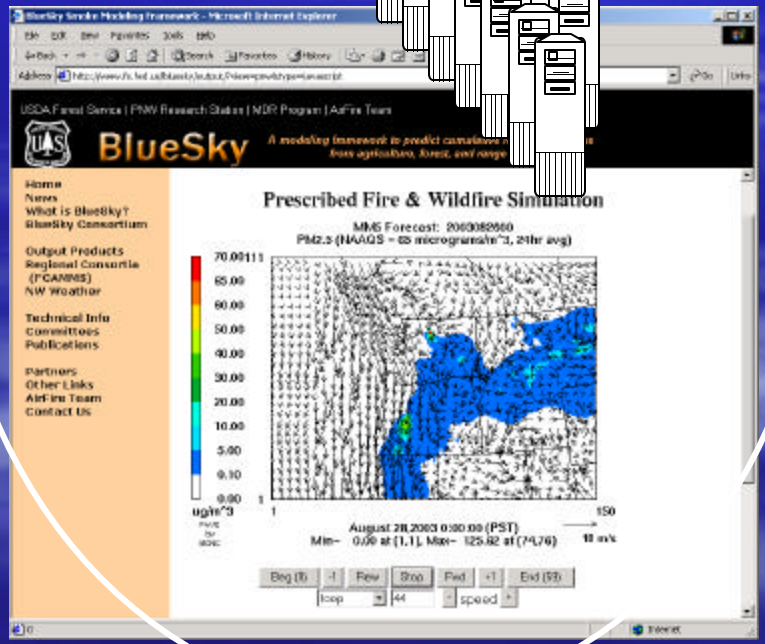
UW Server

NFSpuff

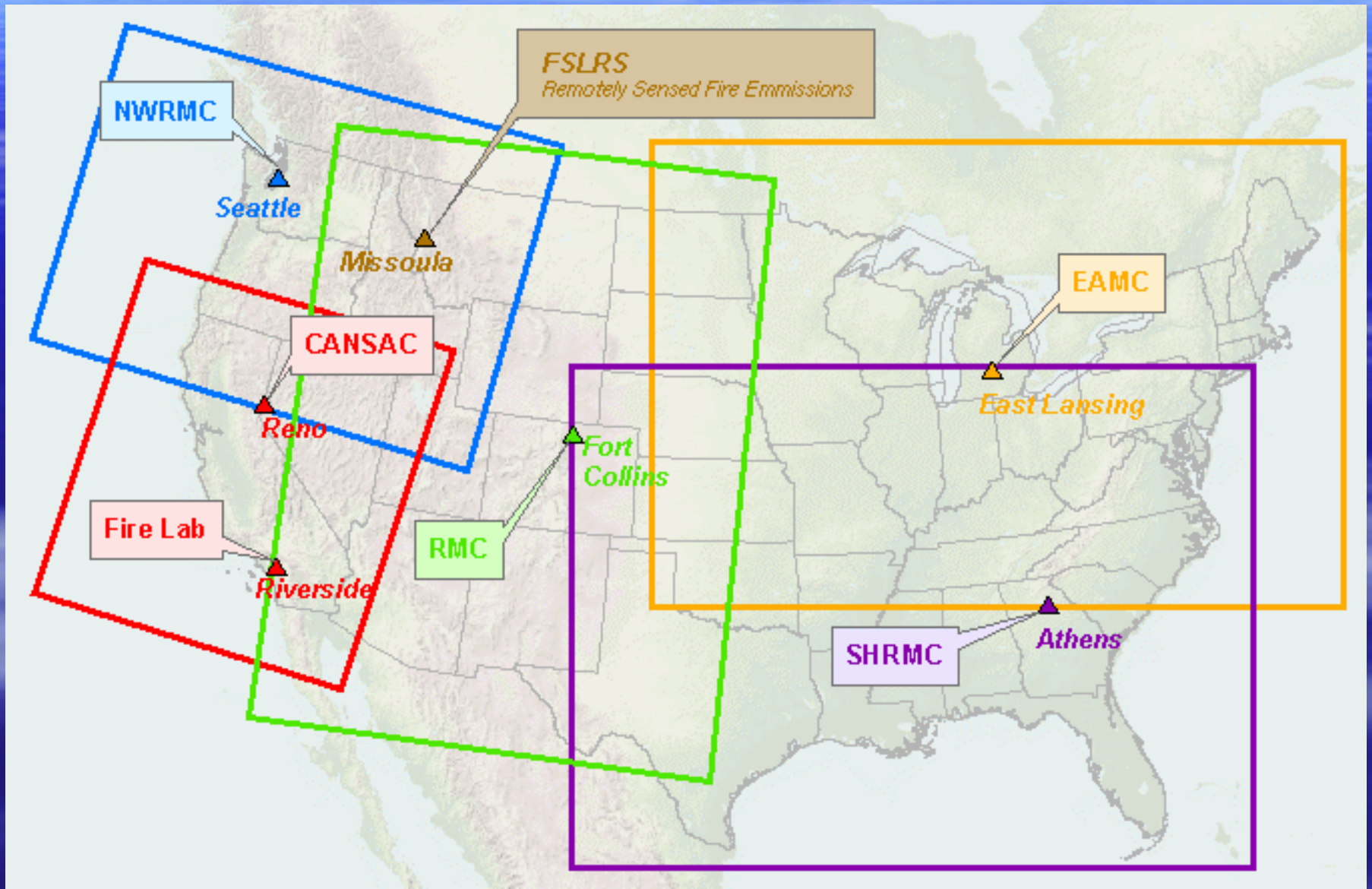


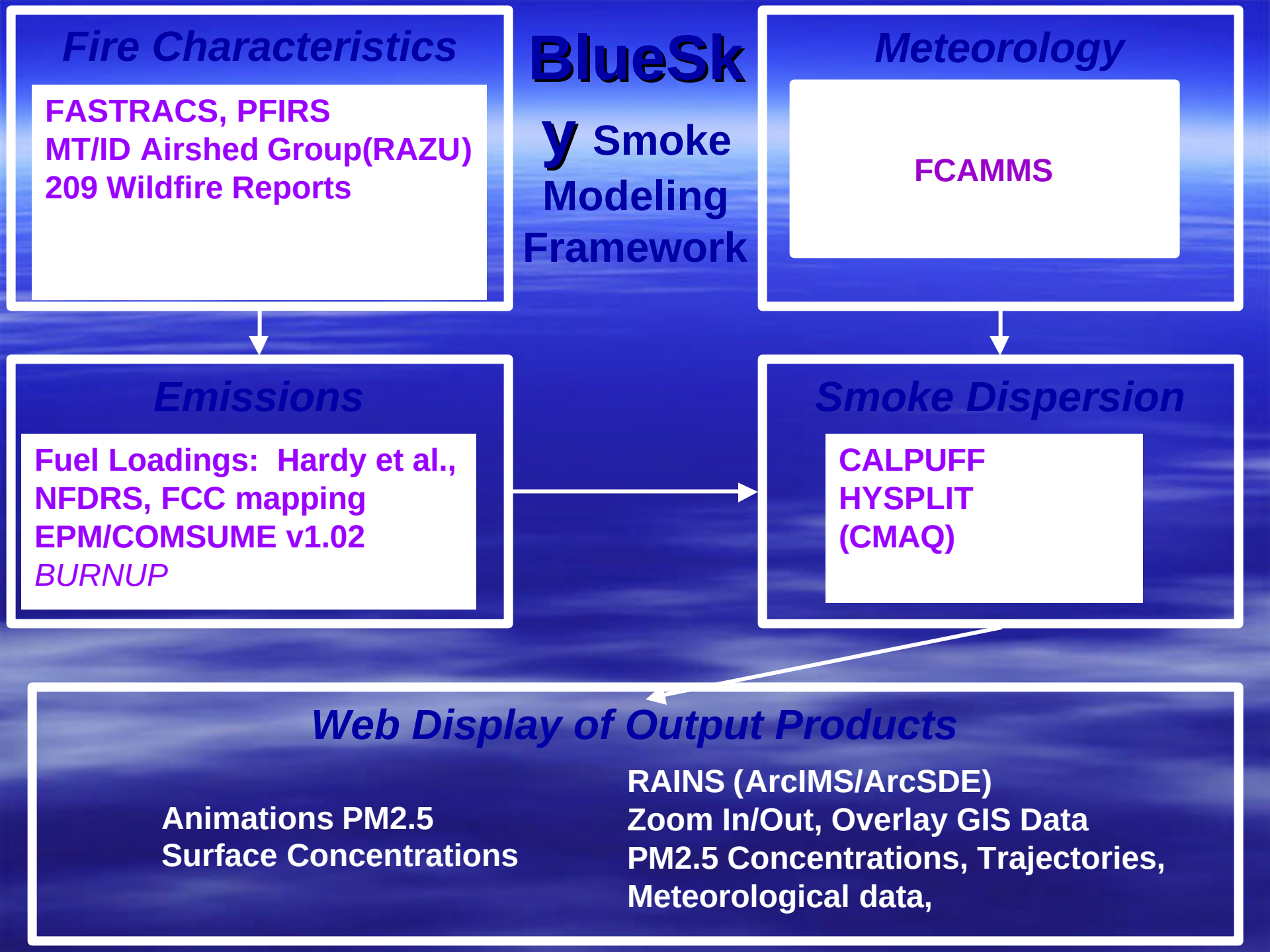
BlueSky

PWFSL
"Beowulf"
Cluster



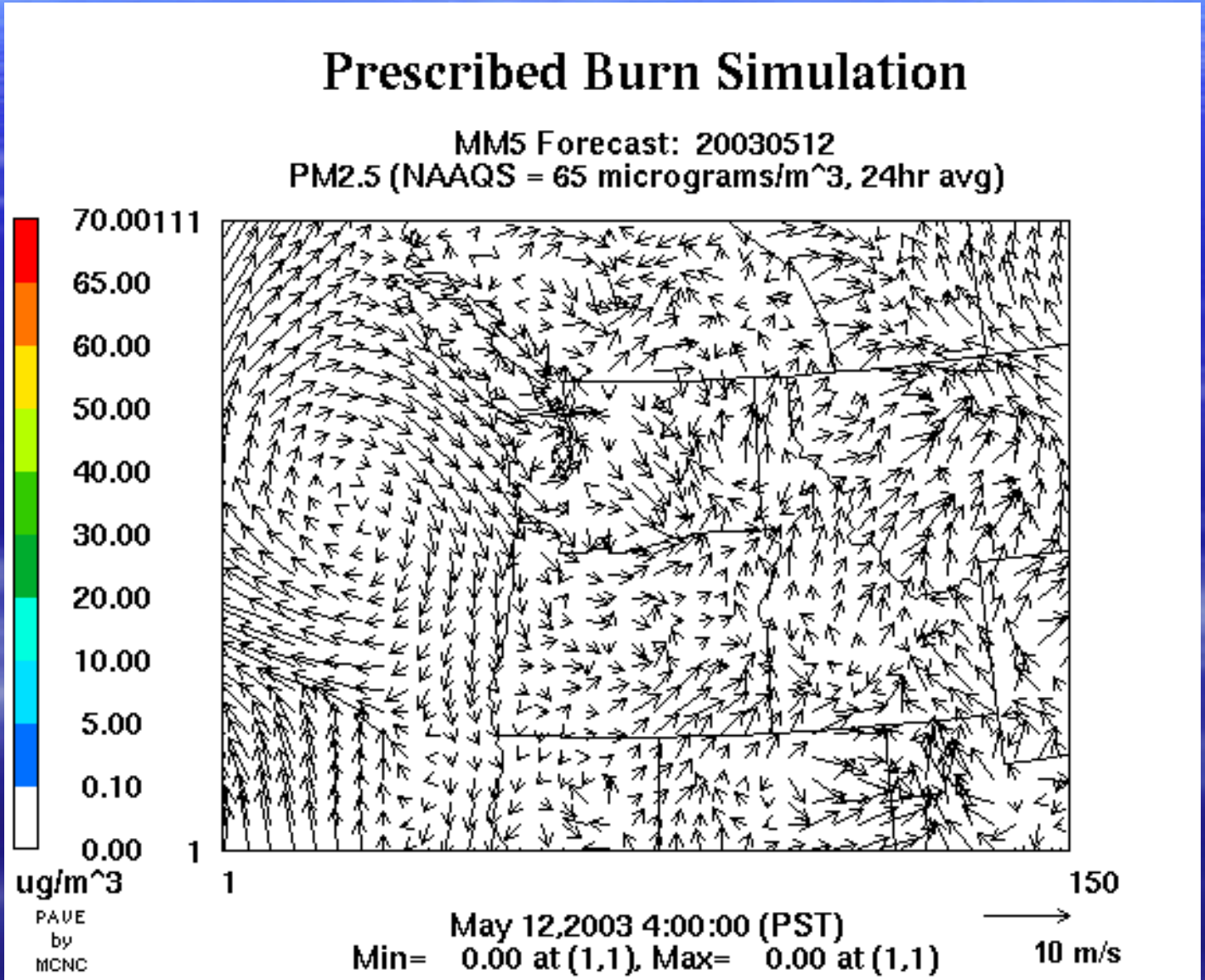
Migration to other FCAMMS Domains



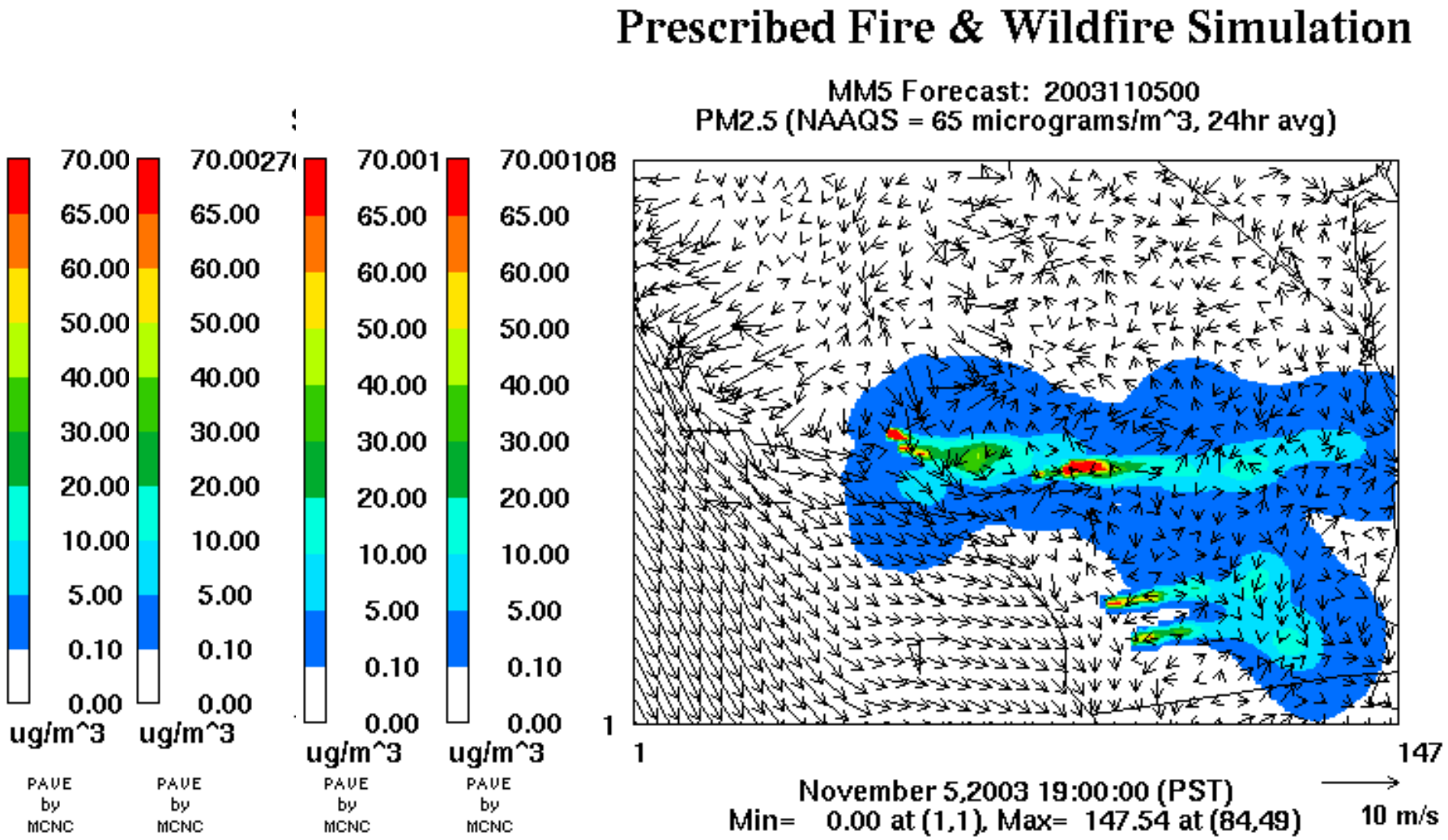

Fire Characteristics
FASTRACS, PFIRS
MT/ID Airshed Group(RAZU)
209 Wildfire Reports
BlueSky Smoke Modeling Framework
Meteorology
FCAMMS
Emissions
Fuel Loadings: Hardy et al., NFDRS, FCC mapping
EPM/COMSUME v1.02
BURNUP
Smoke Dispersion
CALPUFF
HYSPLIT
(CMAQ)
Web Display of Output Products
Animations PM2.5
Surface Concentrations
RAINS (ArcIMS/ArcSDE)
Zoom In/Out, Overlay GIS Data
PM2.5 Concentrations, Trajectories,
Meteorological data,

BlueSky Output Products

60 hr Forecast Animations



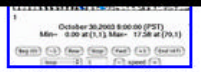
BlueSky Forecasts Smoke from Wildfires for 5 Western Domains



USDA Forest Service | PNW Research Station | MDR Program | AirFire Team

BlueSky

A modeling framework to predict cumulative impacts of smoke from agriculture, forest, and range fires

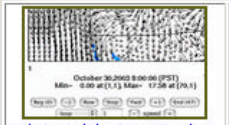

view with JavaScript Animator

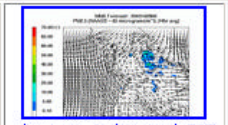

view as Animated GIF

California and Nevada

produced by the **Santa Barbara Atmospheric Research Center** and the **AirFire Team**

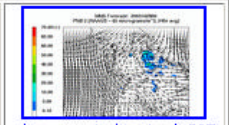
Current Northern California Smoke Impact Forecast (more info)


view with JavaScript Animator


view as Animated GIF

Current Southern California Smoke Impact Forecast (more info)


view with JavaScript Animator


view as Animated GIF

Current Northern and Southern California Weather (MM5) Forecast

Midwest and Northeast regions

produced by the **Eastern Area Modeling Consortium (EAMC)**

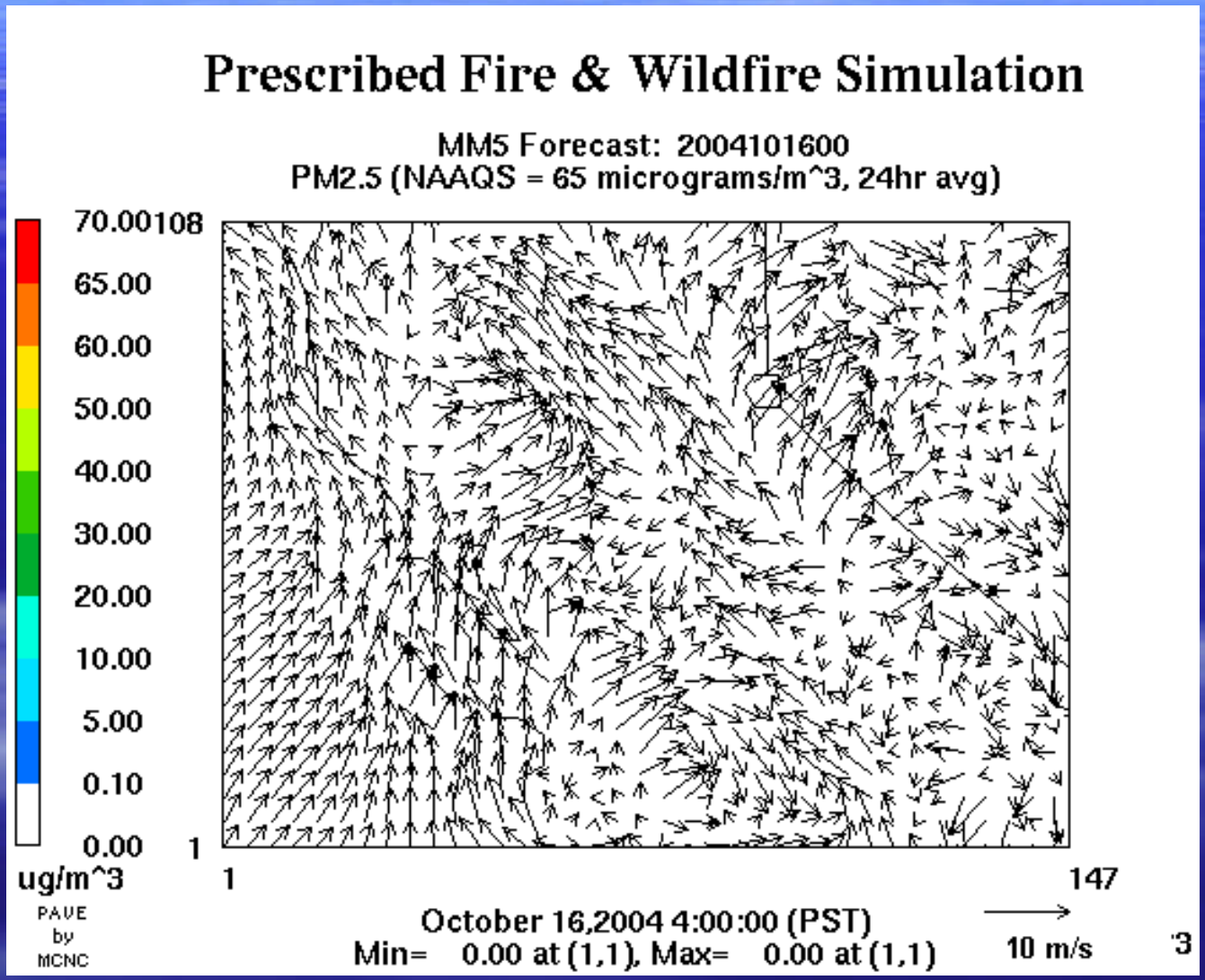
Smoke Forecasts will be coming soon for this region.
Current Midwest and Northeast Fire Weather (MM5) Forecast

Southern regions

produced by the **Southern High Resolution Modeling Consortium (SHRMC)**

Smoke Forecasts will be coming soon for this region.
Current Southern Fire Weather (MM5) Forecast

HOTSPRINGS, FREDS, POWER, & RUMSEY WILDFIRES



What is RAINS?

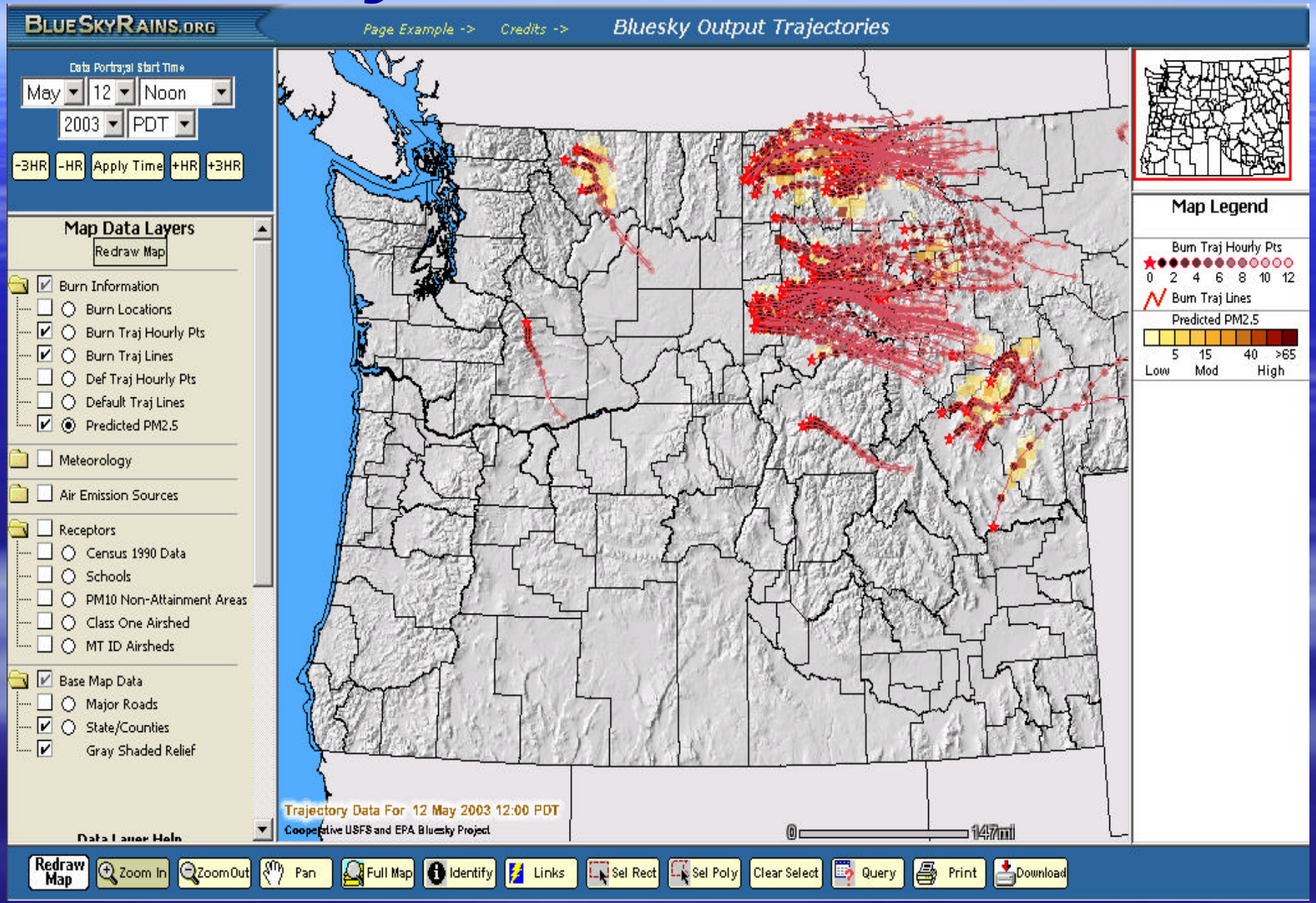
- Rapid Access Information System (RAINS)
  - Geographical Information System (GIS)
  - Using ArcIMS/ArcSDE, SQL server
  - Allowing for web display of BlueSky output products with all the benefits of GIS
- Developed by EPA

BlueSky RAINS

- Combines the BlueSky smoke forecast with the power of RAINS GIS technology.

- Allows for interactive quantitative assessment of smoke impacts from burning activities in the region.

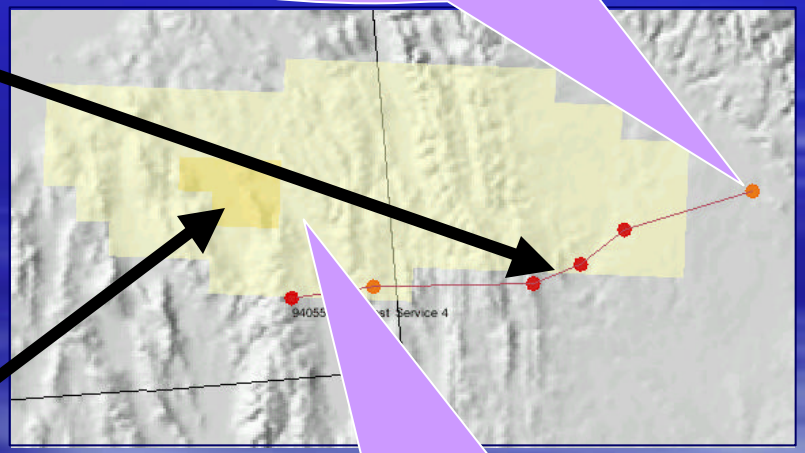
BlueSkyRAINS Output Products



www.BlueSkyRAINS.org

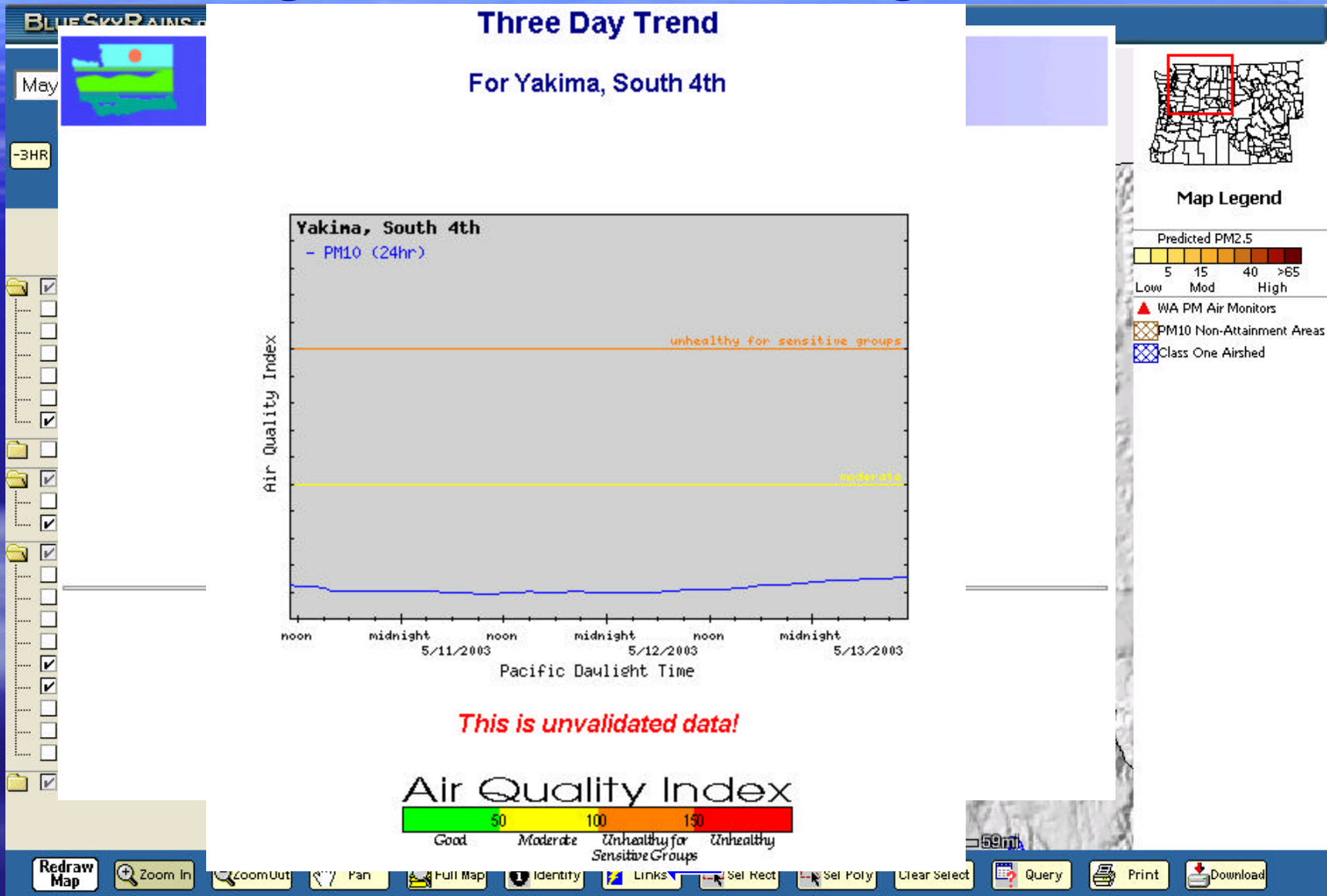
- **Trajectories**
  - Follow air currents *(like a balloon)*
  - May be well above surface
  - New from source each hour during day of burn
- **Surface Concentrations**
  - Result of plume dynamics
  - Always at the surface
  - Cumulated from source each hour during emission period

Dot color indicates height of parcel above surface (red is lowest).

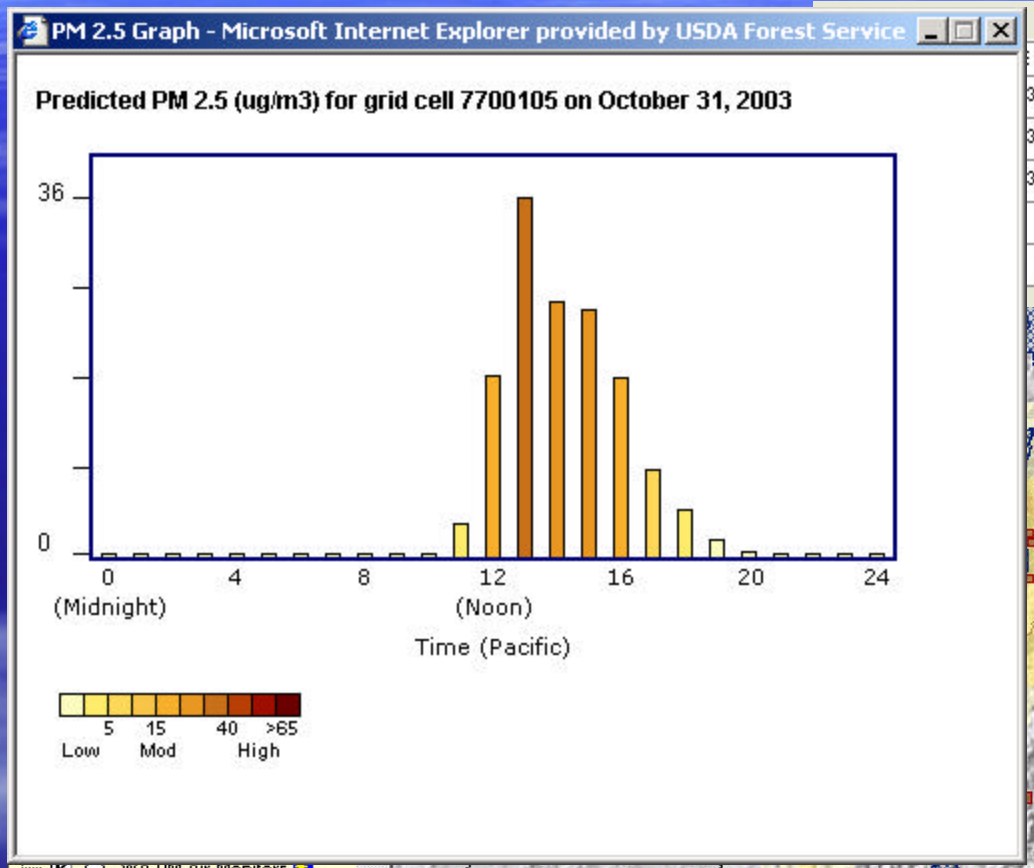


Shade color indicates concentration in µg/m^3.

BlueSkyRAINS:
Linkage with Monitoring Data

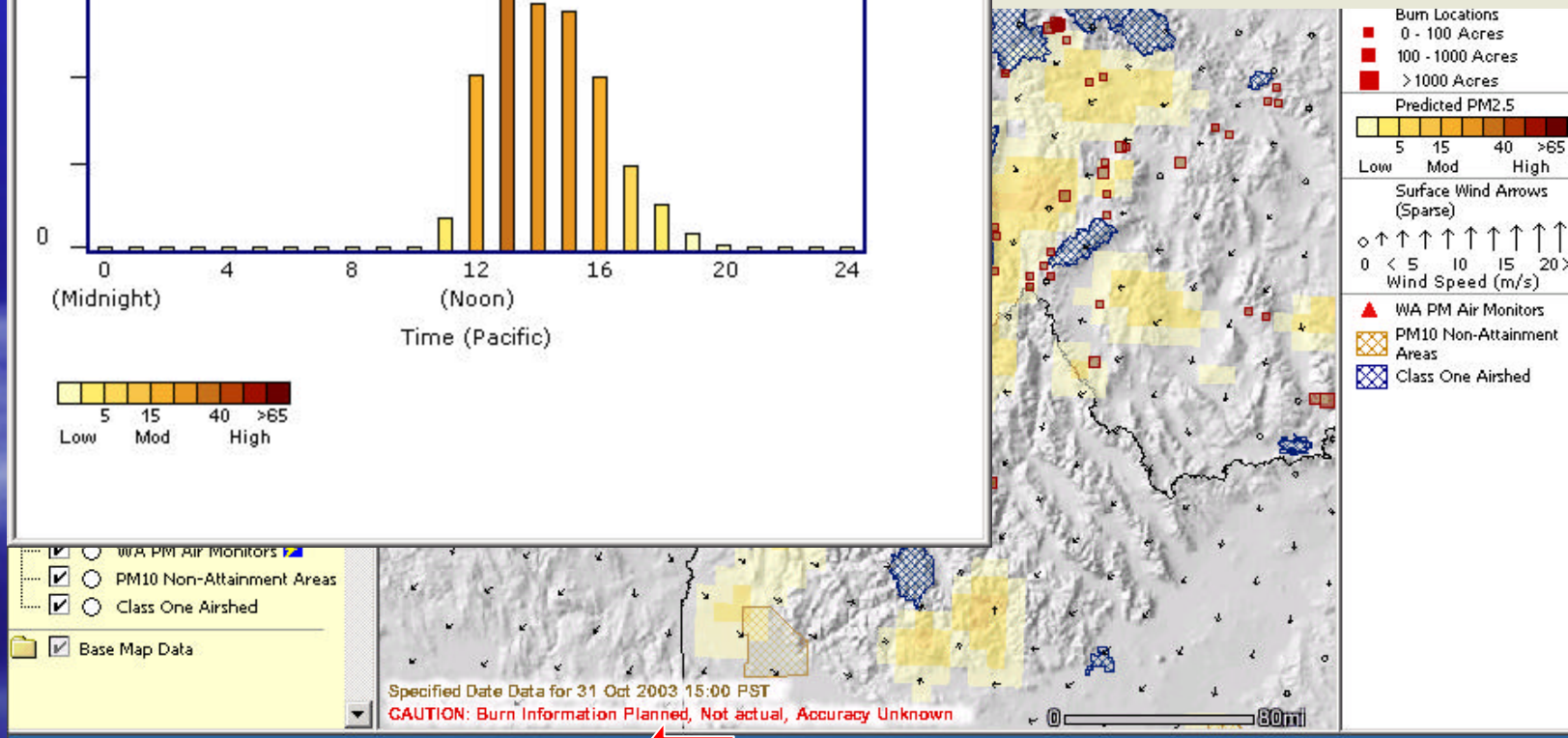


BlueSkyRAINS:
Quantitative Impacts



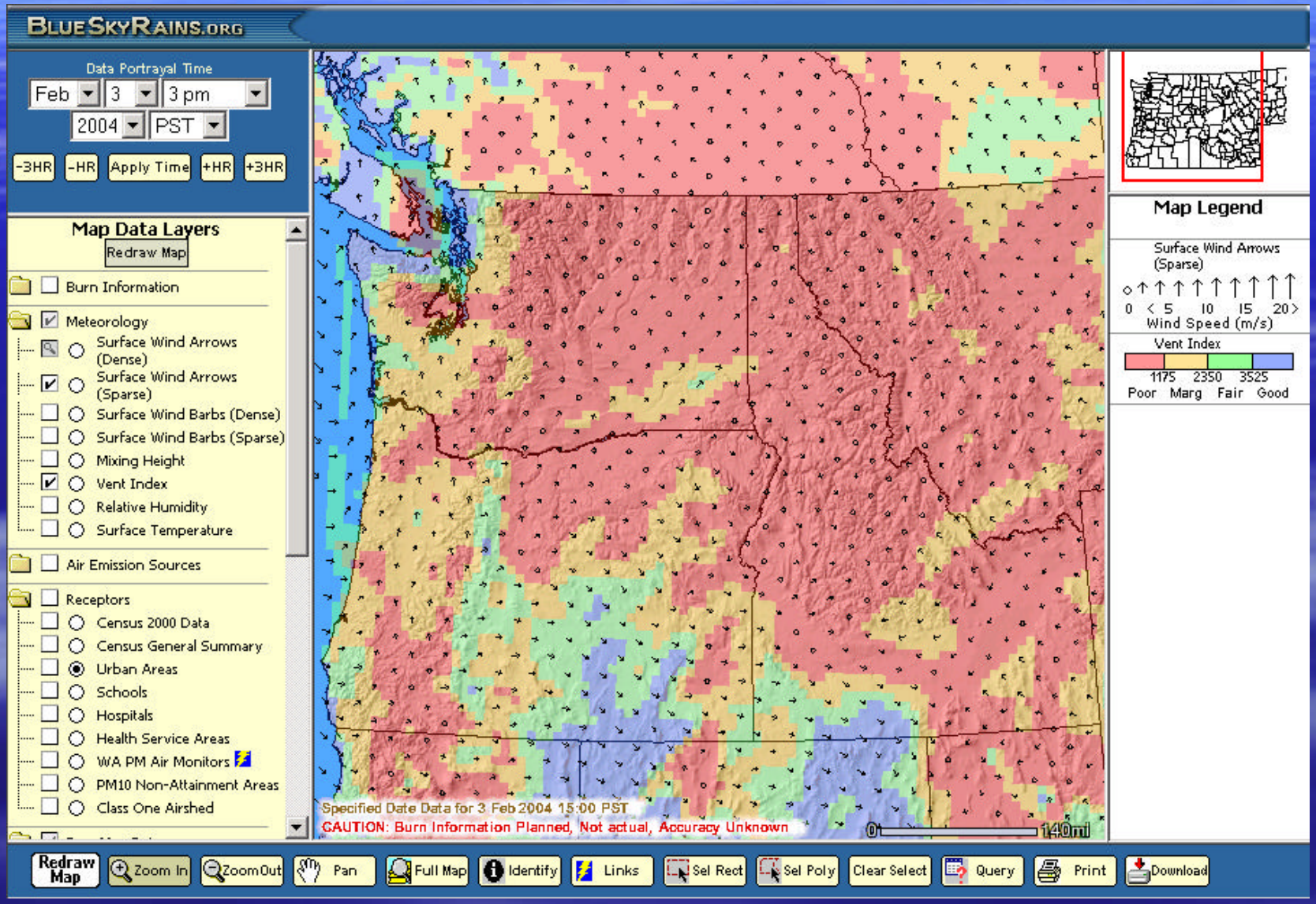
Predicted PM2.5

	XDATE	XHOUR	CELLID	PM2P5	Chart Link
3 23:00:00	20031031	23	7700105	24.44498	Chart
3 23:00:00	20031031	23	7700106	15.85184	Chart
3 23:00:00	20031031	23	7600105	19.83648	Chart
	60093093	69	23000316	60.1333	
	20031031	23	7666772	20.044433	

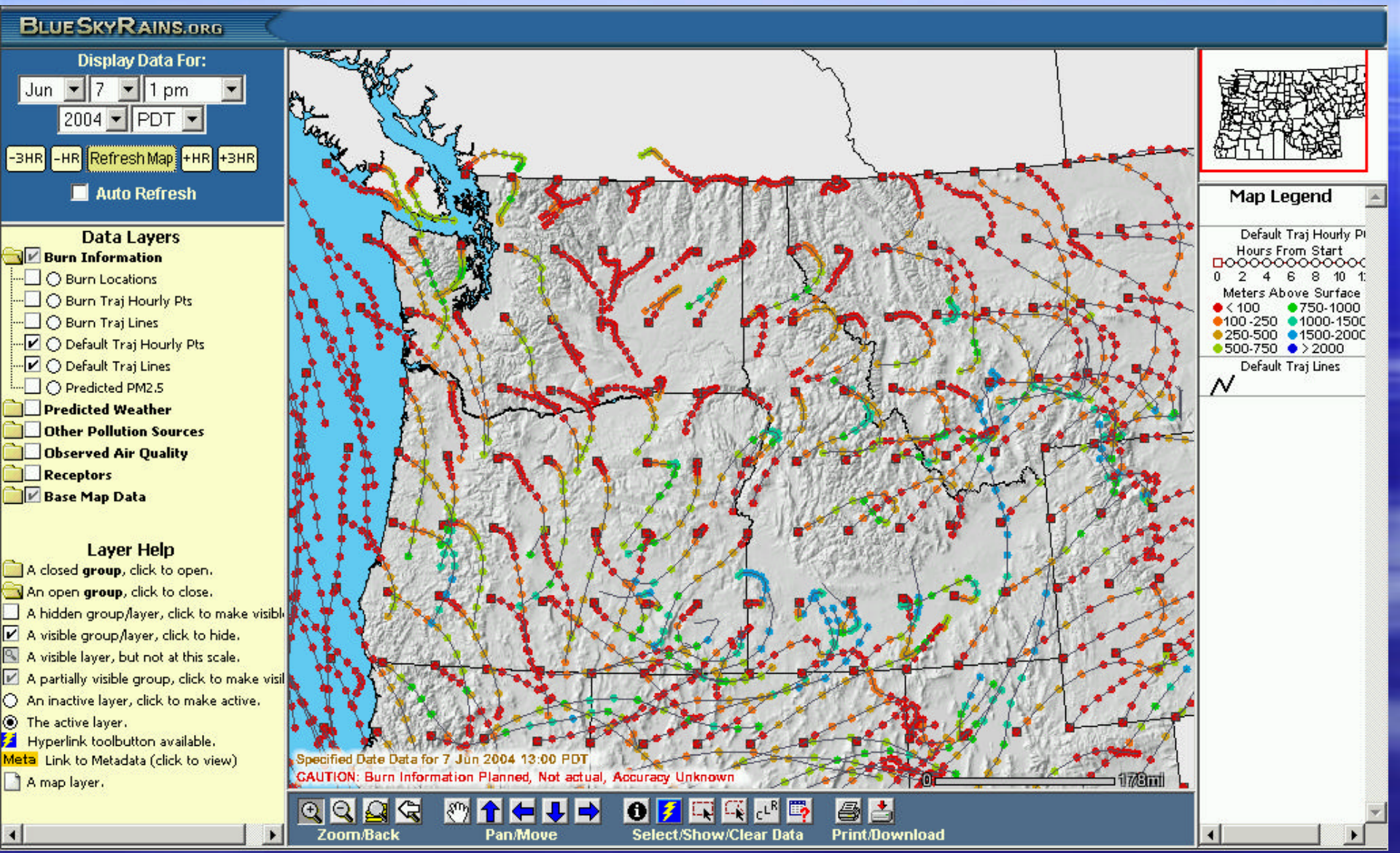


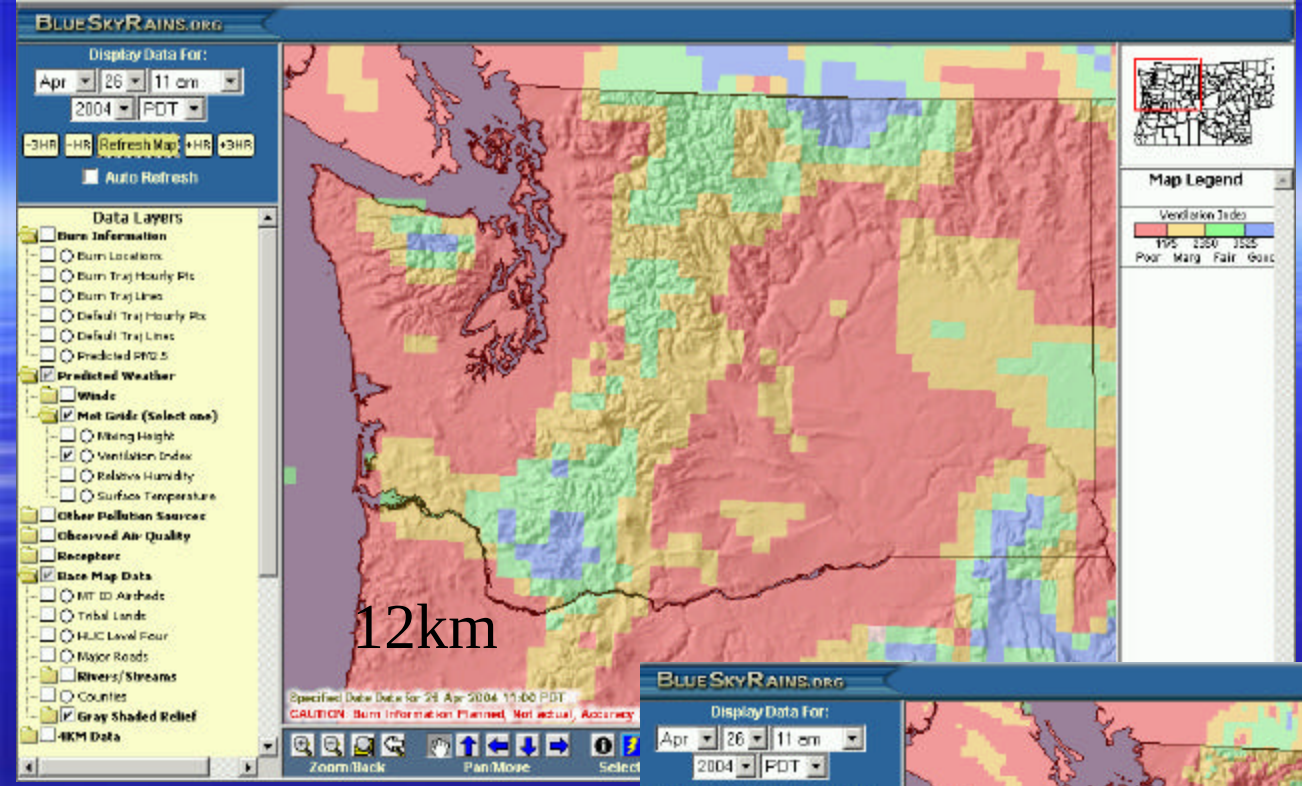
BlueSkyRAINS

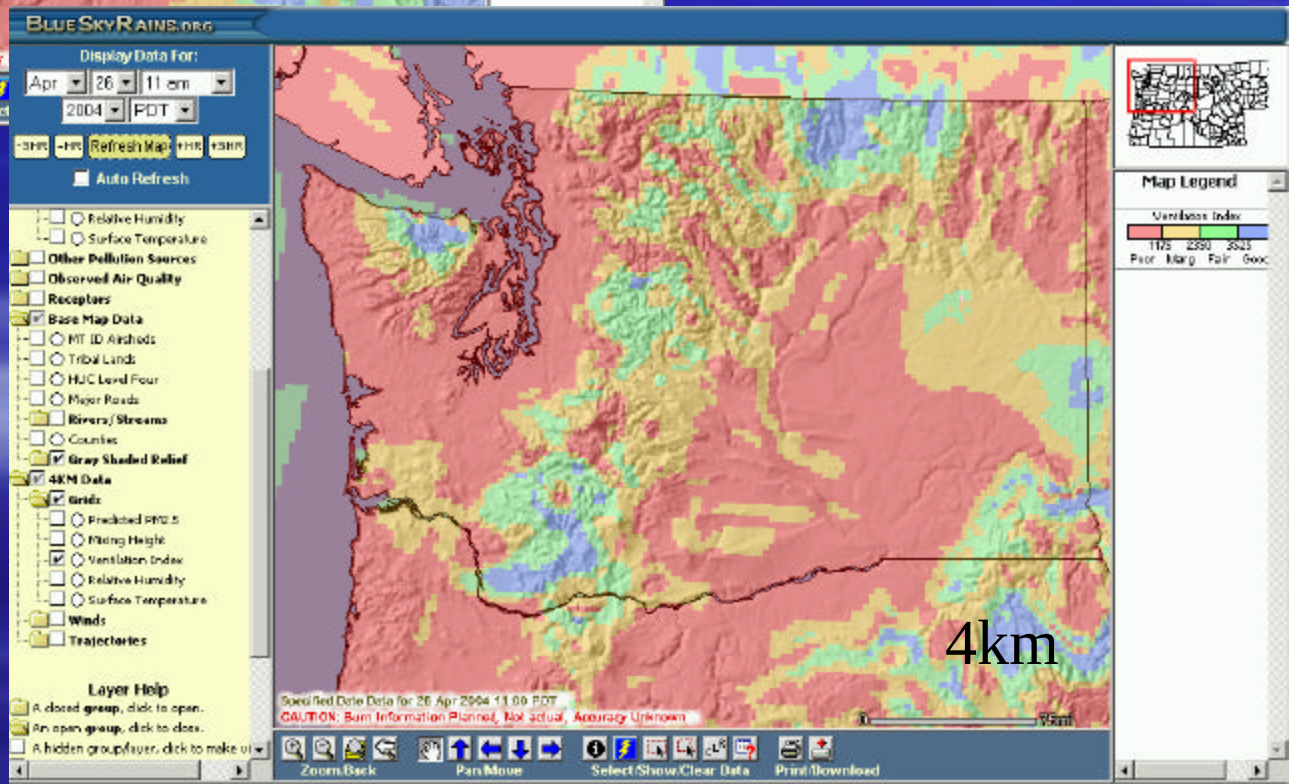
Meteorology for dispersion forecasting



Default Trajectories




BlueSkyRains.org
Display Data For:
Apr 26 11 am
2004 PDT
-3HR -1HR Refresh Map +1HR +3HR
Auto Refresh
Data Layers
Burn Information
Predicted Weather
Wind
Met Grids (Select one)
Mixing Height
Ventilation Index
Relative Humidity
Surface Temperature
Other Pollution Sources
Observed Air Quality
Receptors
Base Map Data
MT ID Airsheds
Tribal Lands
HUC Level Four
Major Roads
Rivers/Streams
Counties
Gray Shaded Relief
4KM Data
Map Legend
Ventilation Index
Poor Marg Fair Good
12km
Zoom/Back
Pan/Move
Select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Display Data For:
Apr 26 11 am
2004 PDT
-3HR -1HR Refresh Map +1HR +3HR
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Relative Humidity
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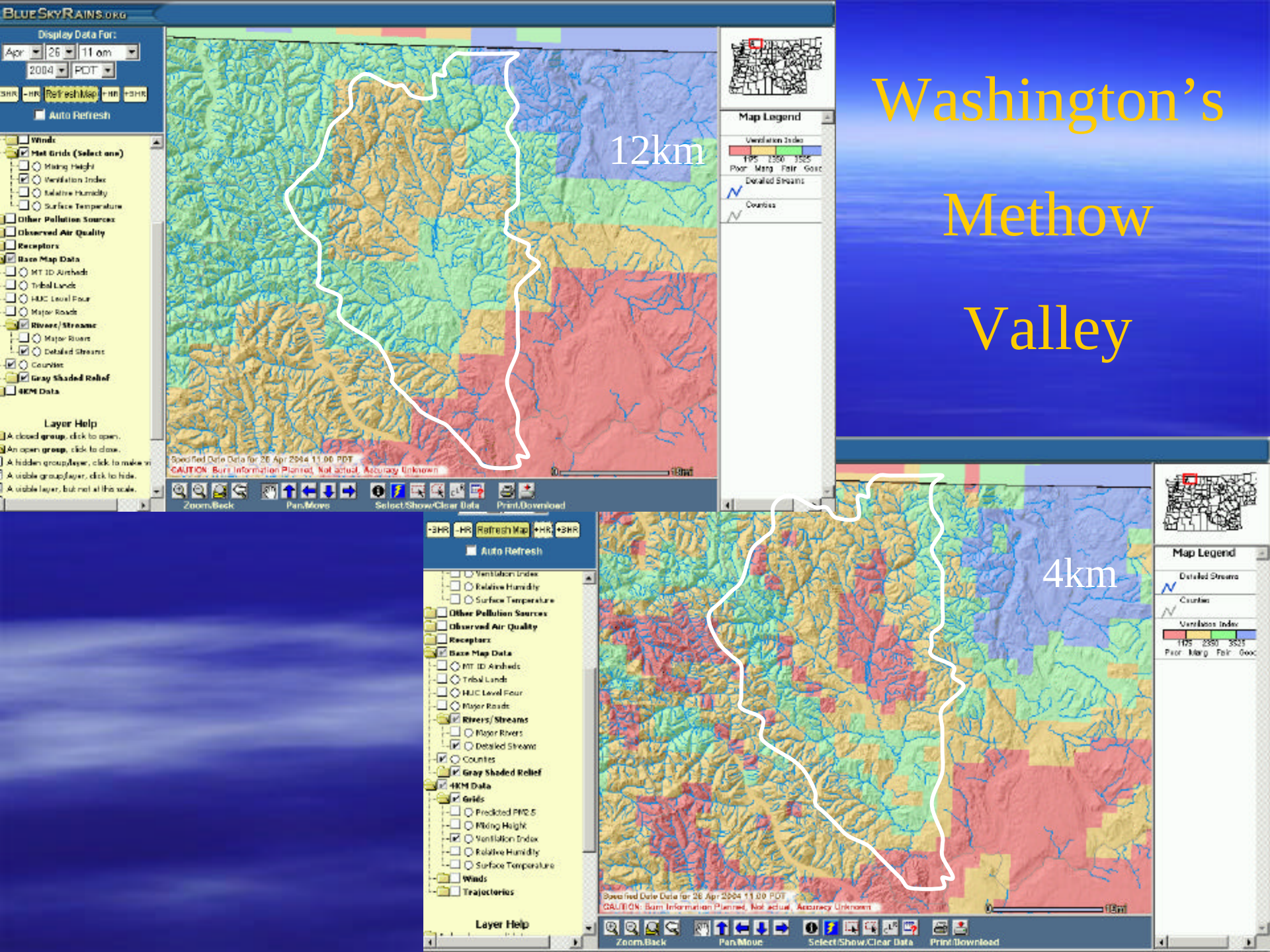
Gray Shaded Relief
4KM Data
Grids
Predicted PM2.5
Mixing Height
Ventilation Index
Relative Humidity
Surface Temperature
Winds
Trajectories
Layer Help
Map Legend
Ventilation Index
Poor Marg Fair Good
4km
Zoom/Back
Pan/Move
Select/Show/Clear Data
Print/Download


BlueSkyRains.org
Display Data For:
Apr 26 11 am
2004 PDT
-3HR -HR Refresh Map +HR +3HR
Auto Refresh
Map Legend
12km
Zoom/Back
Pan/Move
Select/Show/Clear Data
Print/Download
Layer Help
Washington's
Methow
Valley
4km

BlueSky RAINS

Applications

- Prescribed Fires
- Wildfires
- Agricultural Burning

- Incident command teams
  - Public information
  - Planning burnouts
  - Aircraft resource allocation
- Local burners
  - go/no-go/go-slow decisions
  - Negotiation tool
- Smoke managers
  - Cumulative effects monitoring
  - Emission tracking
- Air Regulators
  - Cumulative effects monitoring
  - Emission tracking
  - go/no-go decisions
- All Users
  - Impact assessment & mitigation

WESTERN BLUESKY RAINS

Information about Potential Wildfire Smoke Impacts

Funded & Sponsored by the USFS and USEPA

- Home
- Overview
- Animations
- National Coordination
- Weather
- Related Links
- Help
- Privacy & Security

Email Questions or Comments to:

Dr. Sue A. Ferguson,
USFS
sferguson@fs.fed.us

Rob Wilson,
USEPA
wilson.rob@epa.gov

View Wildfire Smoke Forecast Maps (Forecast initialized at 00 UTC Nov 04 2004)

Select A Forecast Map Below

1. Select a map area or domain

Western United States

2. Select the forecast date & time

Oct | 1 | 2004
8 am | PDT

3. Select the type of forecast

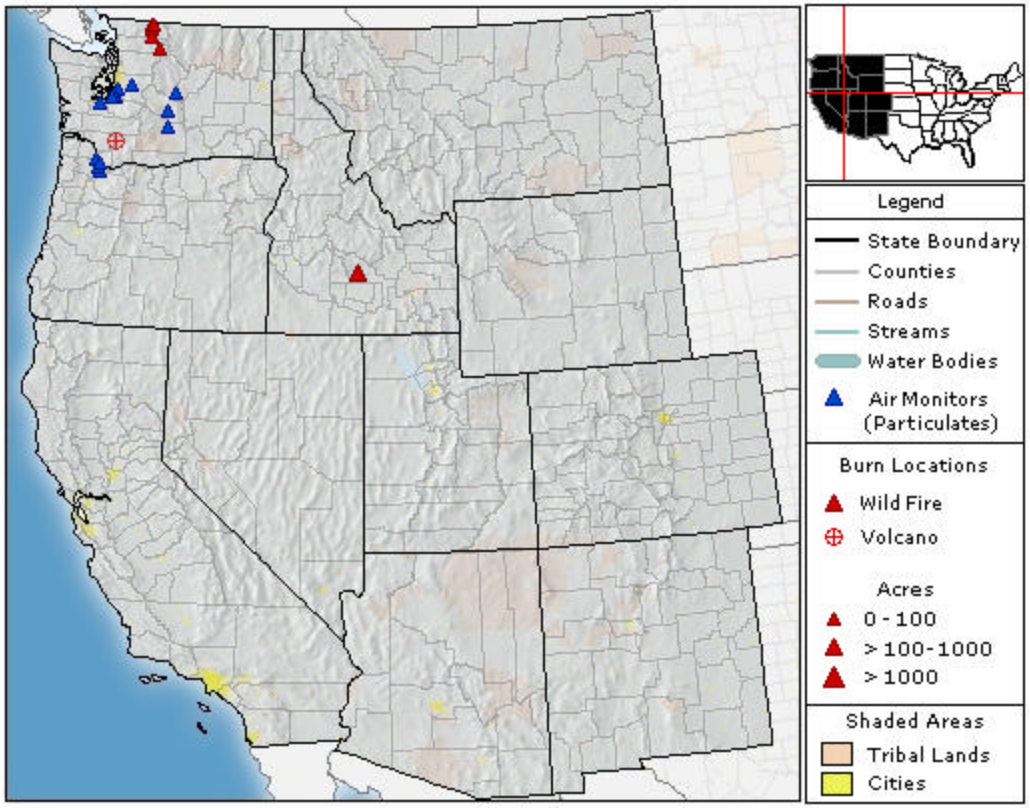
- [x] Smoke Forecast
- [ ] Meteorology
- [ ] Default Smoke Trajectories

4. Generate the Forecast Map(s)

Click here to view Forecast Maps ▶
*or click on the map to view a local forecast map for your area

Additional Information:
US Forest Service Volcano Cam
(refresh page for latest image)

View Air Quality Forecasts ▶ AIRNOW



Caution: Maps are derived from automated Wildfire Reports and modeled smoke and weather predictions. Actual impacts may deviate from mapped displays.

http://westernblueskyrains.epa.gov/website/bluewest/viewer.htm?Box=-927109.0:1088459.0:1212052. - Microsoft Internet Explorer p

Western BlueSkyRains

Information about Potential Wildfire Smoke Impacts

Display Data For:

Oct | 2 | 8 pm

2004 | PDT

-3HR | -HR | Refresh Map | +HR | +3HR

Auto Refresh

Data Layers

Data Status

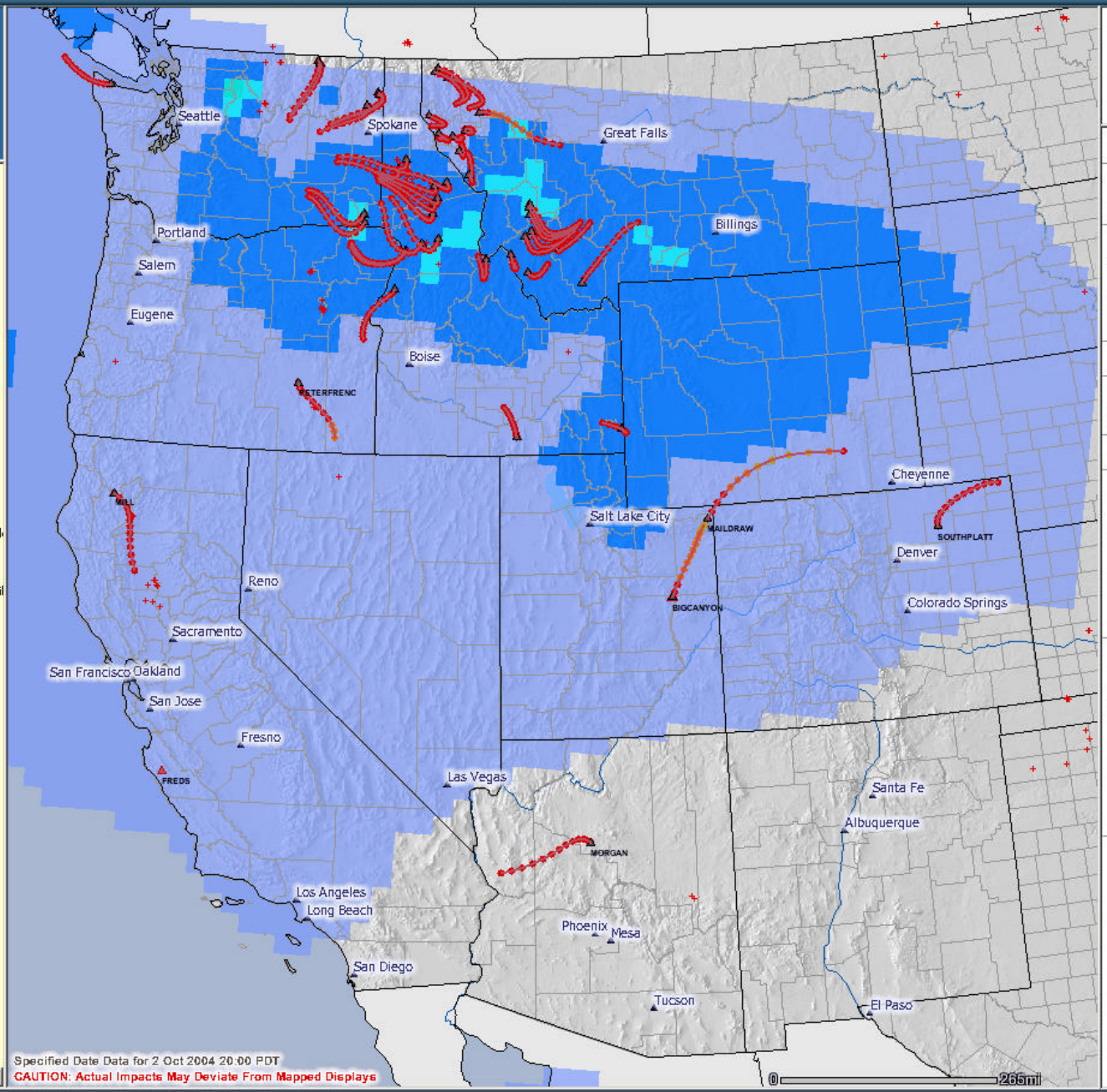
- Burn Information (36km)
- Predicted Weather (36km)
- NOAA Fire/Smoke Information
- Mt St Helens Information
- Other Pollution Sources
- Observed Air Quality
- Receptors
- Base Map Data

AIRNOW | Bluesky Animations

Bluesky Pacific NW | NOAA Animations

Layer Help

- A closed **group**, click to open.
- An open **group**, click to close.
- A hidden group/layer, click to make visibl
- A visible group/layer, click to hide.
- A visible layer, but not at this scale.
- A partially visible group, click to make visil
- An inactive layer, click to make active.
- The active layer.
- Hyperlink toolbutton available.
- Meta Link to Metadata (click to view)
- A map layer.



Map Legend

Wildfire Locations
- 0 - 100 Acres
- 100 - 1000 Acres
- >1000 Acres

Burn Traj Hourly Pts
Hours From Start
0 2 4 6 8 10 12

Meters Above Surface
- < 100
- 100 -250
- 250-500
- 500-750
- 750-1000
- 1000-1500
- 1500-2000
- > 2000

Burn Traj Lines

Predicted PM2.5 36km
1 5 10 20 40 60 >65
Low Mod High

NOAA Fire Detects

Traj Lines Rlse <= 1000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12

Based On 4km Met Data
& release abv surface
- 10m
- 500m
- 1,000m

Traj Lines Rlse >= 3000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12

Based On 4km Met Data
& release abv surface
- 3,000m
- 6,000m
- 9,000m
- 12,000m
- 15,000m

Tool Help | Zoom/Back | Pan/Move | Select/Show/Clear Data | Print/Download

http://westernblueskyrains.epa.gov/website/bluewest/viewer.htm?Box=-927109.0:1088459.0:1212052. - Microsoft Internet Explorer p

Western BlueSkyRains

Information about Potential Wildfire Smoke Impacts

Display Data For:

Oct | 21 | 5 am

2004 | PDT

-3HR | -HR | Refresh Map | +HR | +3HR

Auto Refresh

Data Layers

Data Status

- **Burn Information (36km)**
- **Predicted Weather (36km)**
- **NOAA Fire/Smoke Information**
  - NOAA Observed Smoke
  - NOAA Fire Detects
  - NOAA Hysplit Soot Forecast Meta
- **Mt St Helens Information**
- **Other Pollution Sources**
- **Observed Air Quality**
  - AirNow PM2.5 Monitors
  - WA PM Air Monitors
- **Receptors**
- **Base Map Data**

AIRNOW | Bluesky Animations

Bluesky Pacific NW | NOAA Animations

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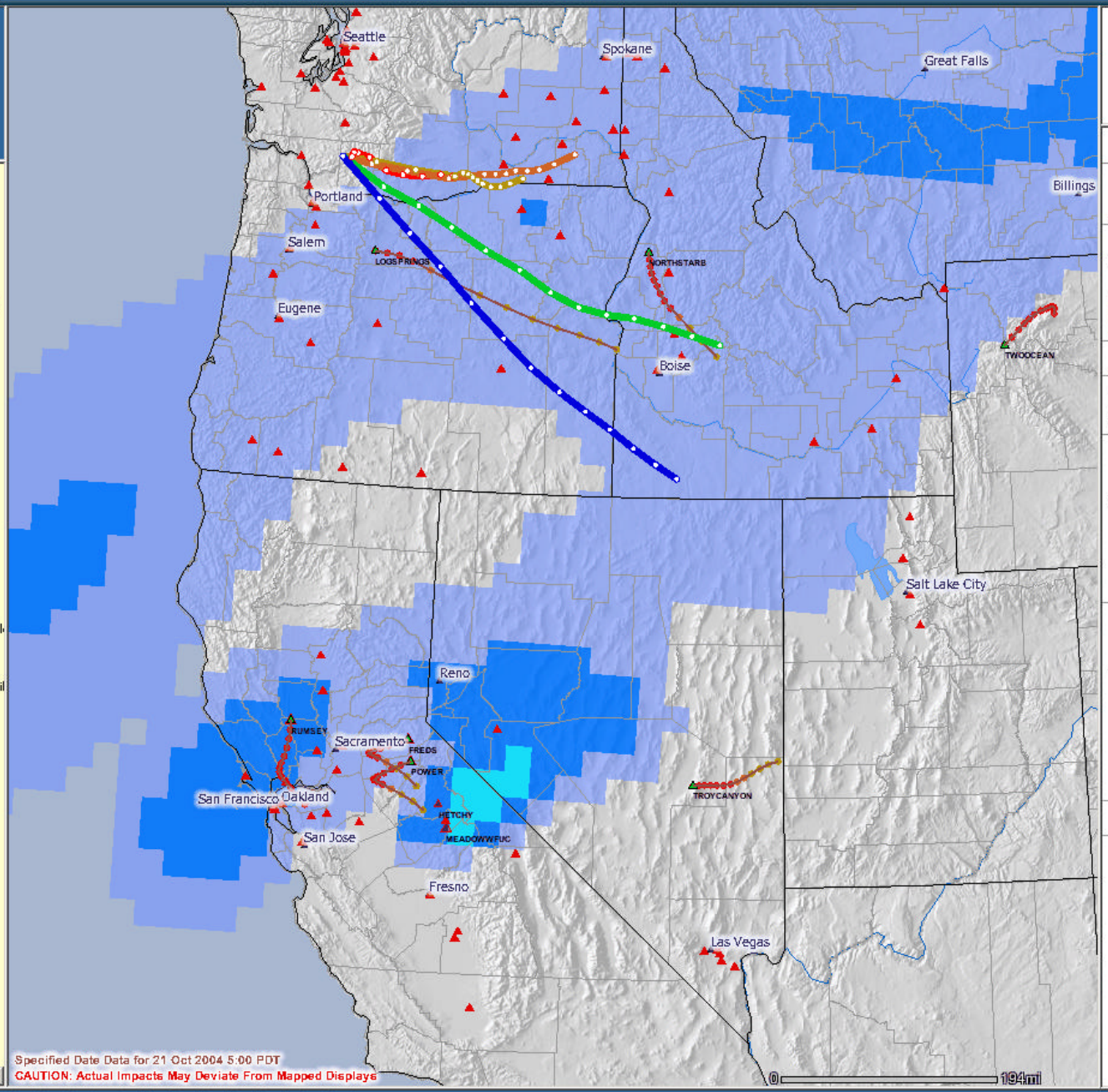

Map Legend

Wildfire Locations
0 - 100 Acres
100 - 1000 Acres
>1000 Acres

Burn Traj Hourly Pts
Hours From Start
0 2 4 6 8 10 12

Meters Above Surface
< 100 | 750-1000
100 -250 | 1000-1500
250-500 | 1500-2000
500-750 | > 2000

Burn Traj Lines

Predicted PM2.5 36km
1 5 10 20 40 60 >65
Low Mod High

Traj Lines Rlse <= 1000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12

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& release abv surface
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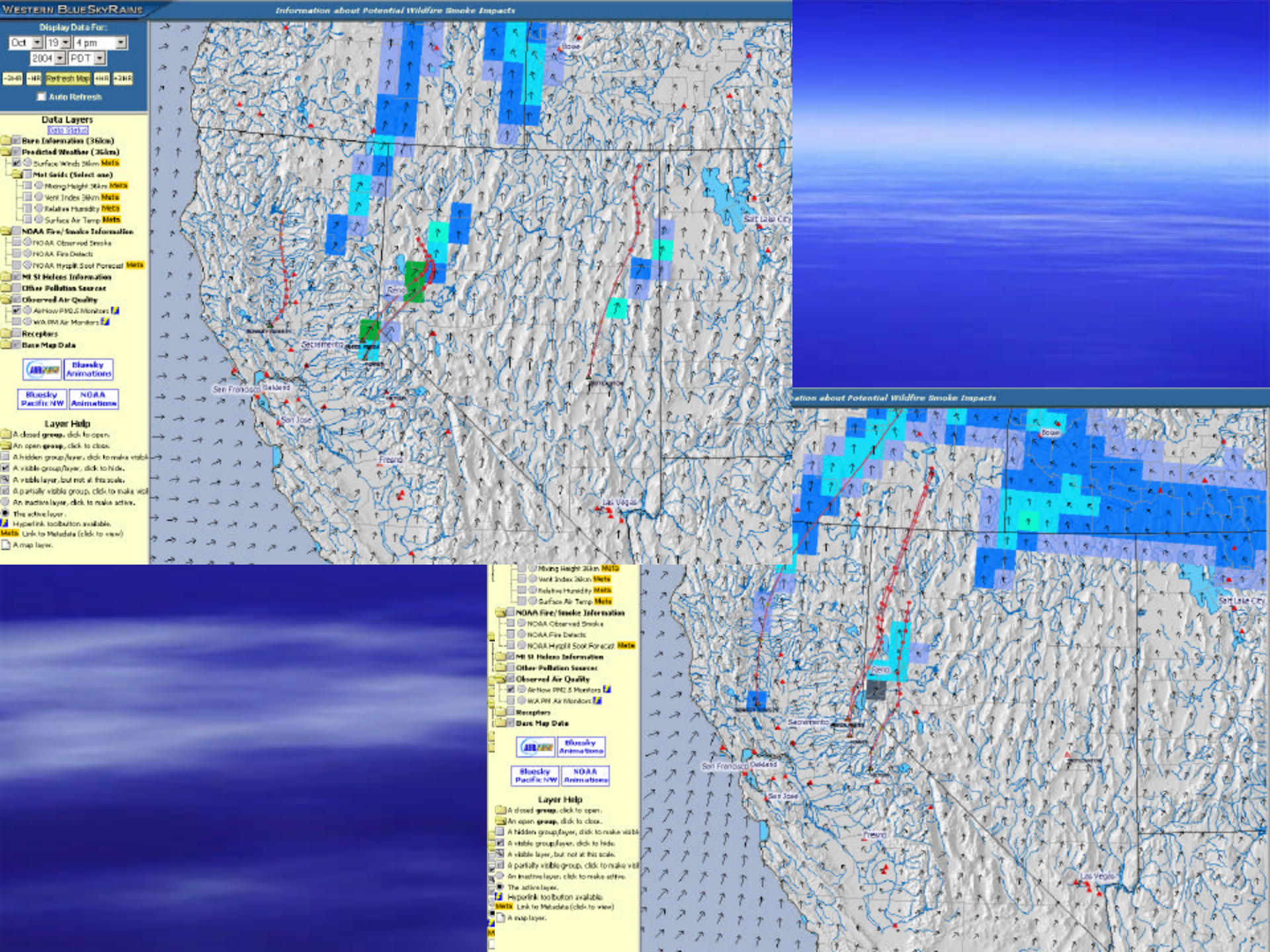
500m
1,000m

Traj Lines Rlse >= 3000m
Mount St. Helens
Predicted Trajectories
Hours From Start
0 2 4 6 8 10 12

Based On 4km Met Data
& release abv surface
3,000m
6,000m
9,000m
12,000m
15,000m

AirNow PM2.5 Monitors

Tool Help | Zoom/Back | Pan/Move | Select/Show/Clear Data | Print/Download


Western BlueSkyRains
Information about Potential Wildfire Smoke Impacts
Display Data For:
Oct 19 4 pm
2004 PDT
-24HR -HR Refresh Map +HR +24HR
Auto Refresh
Data Layers
Data Status
Burn Information (36km)
Predicted Weather (36km)
Surface Winds 36km Meta
Met Grids (Select one)
Mixing Height 36km Meta
Vent Index 36km Meta
Relative Humidity Meta
Surface Air Temp Meta
NOAA Fire/Smoke Information
NOAA Observed Smoke
NOAA Fire Detects
NOAA Hysplit Soot Forecast Meta
Mt St Helens Information
Other Pollution Sources
Observed Air Quality
AirNow PM2.5 Monitors
WA PM Air Monitors
Receptors
Base Map Data
Bluesky Animations
Bluesky Pacific NW
NOAA Animations
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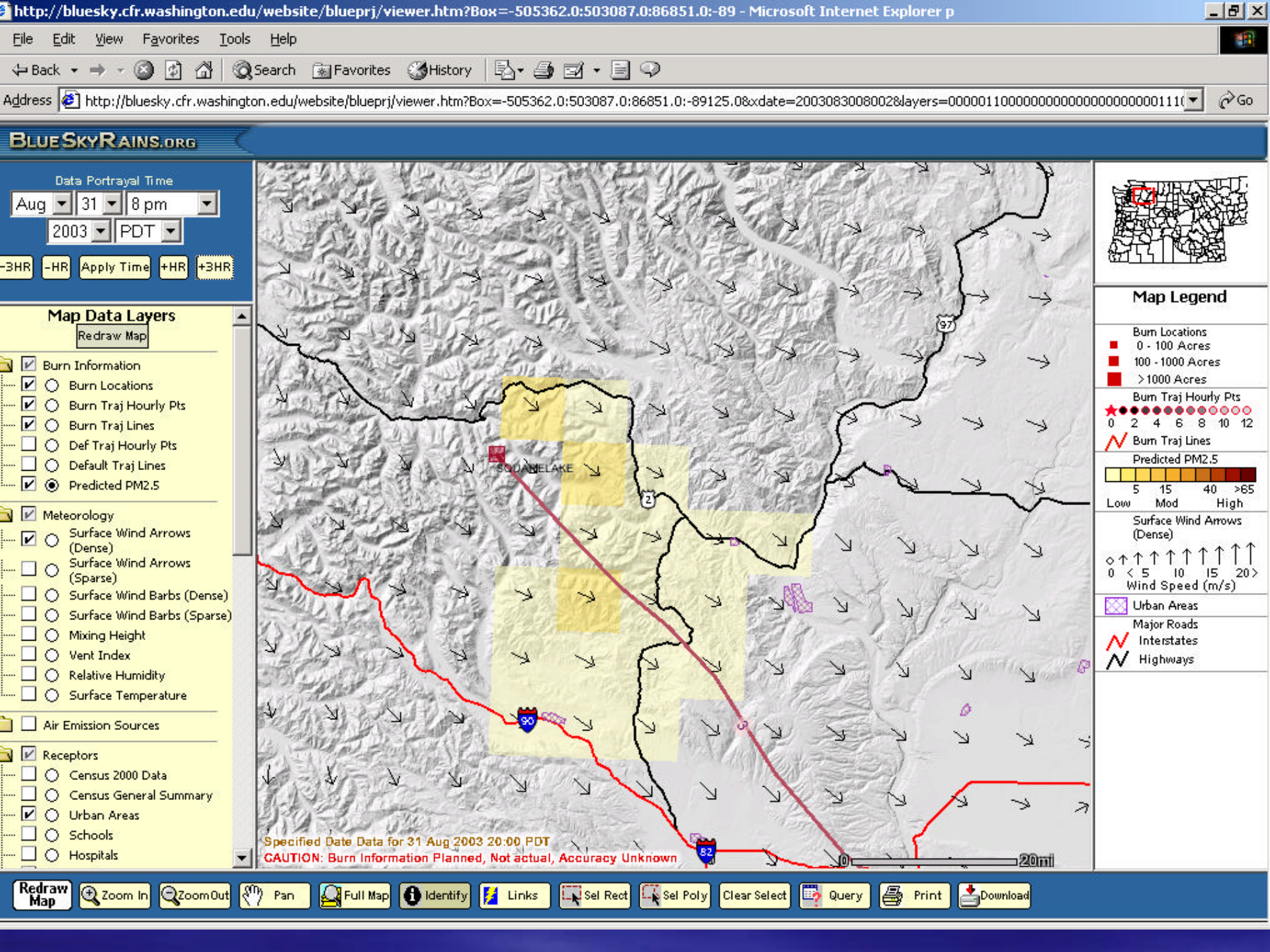
A map layer.
Boise
Salt Lake City
Reno
Sacramento
San Francisco
Oakland
San Jose
Fresno
Las Vegas

Square Lake Fire

- August 30 – Sept 1, 2003
- Near Leavenworth, WA
- Labor Day Weekend
- Large burnout planned
- Some flexibility in timing
- Minimize smoke impact to community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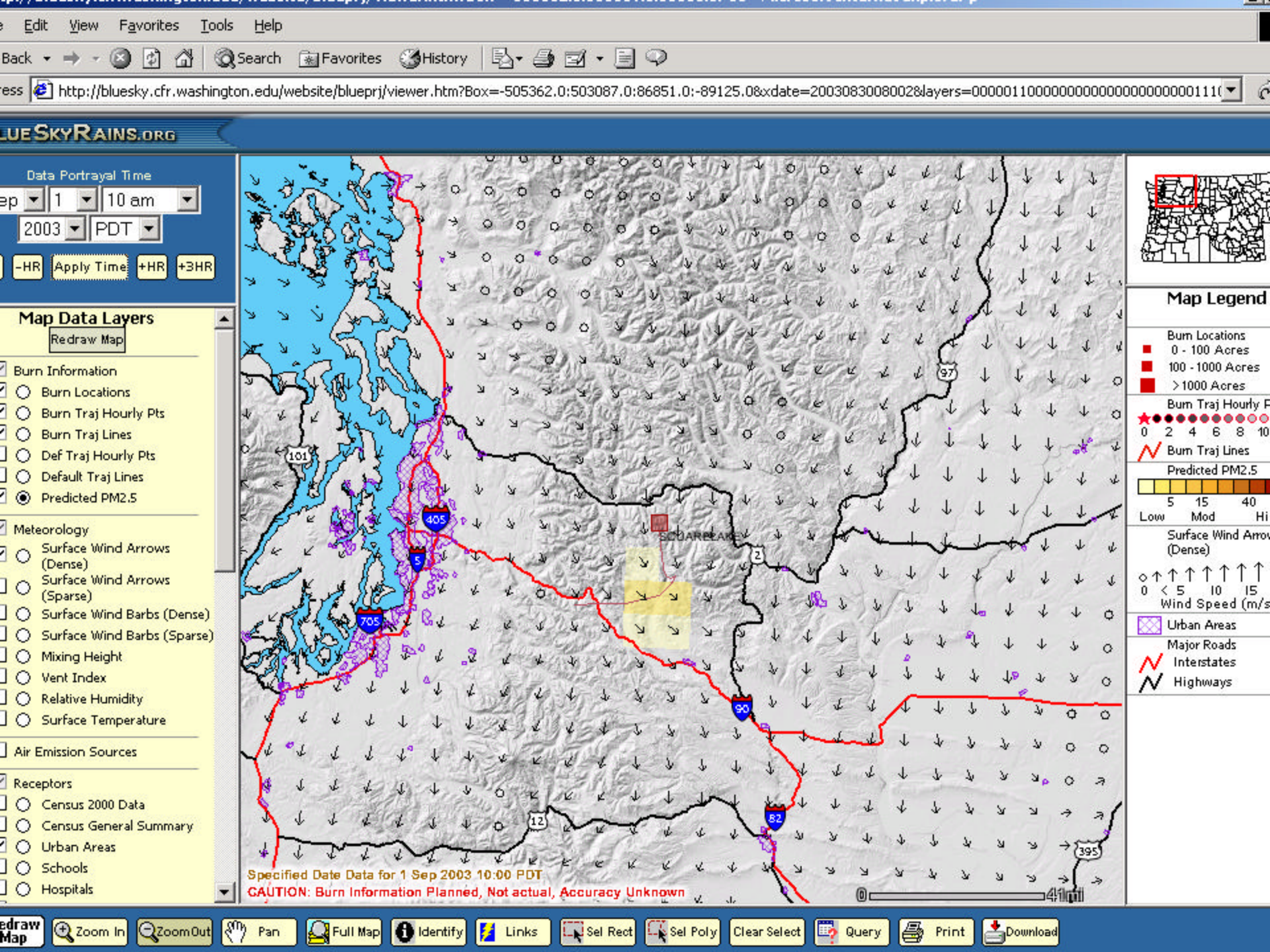
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://bluesky.cfr.washington.edu/website/blueprj/viewer.htm?Box=-505362.0:503087.0:86851.0:-89125.0&xdate=2003083008002&layers=0000011000000000000000000000111
Go
BLUESKYRAINS.ORG
Data Portrayal Time
Aug 31 8 pm
2003 PDT
-3HR -HR Apply Time +HR +3HR
Map Data Layers
Redraw Map
Burn Information
Burn Locations
Burn Traj Hourly Pts
Burn Traj Lines
Def Traj Hourly Pts
Default Traj Lines
Predicted PM2.5
Meteorology
Surface Wind Arrows (Dense)
Surface Wind Arrows (Sparse)
Surface Wind Barbs (Dense)
Surface Wind Barbs (Sparse)
Mixing Height
Vent Index
Relative Humidity
Surface Temperature
Air Emission Sources
Receptors
Census 2000 Data
Census General Summary
Urban Areas
Schools
Hospitals
SQUAMELAKE
97
2
90
82
Specified Date Data for 31 Aug 2003 20:00 PDT
CAUTION: Burn Information Planned, Not actual, Accuracy Unknown
0
20mi
Map Legend
Burn Locations
0 - 100 Acres
100 - 1000 Acres
>1000 Acres
Burn Traj Hourly Pts
0 2 4 6 8 10 12
Burn Traj Lines
Predicted PM2.5
5 15 40 >65
Low Mod High
Surface Wind Arrows (Dense)
0 < 5 10 15 20>
Wind Speed (m/s)
Urban Areas
Major Roads
Interstates
Highways
Redraw Map
Zoom In
Zoom Out
Pan
Full Map
Identify
Links
Sel Rect
Sel Poly
Clear Select
Query
Print
Download


Edit View Favorites Tools Help
Back Search Favorites History
http://bluesky.cfr.washington.edu/website/blueprj/viewer.htm?Box=-505362.0:503087.0:86851.0:-89125.0&xdate=2003083008002&layers=0000011000000000000000000000011
LUESKYRAINS.ORG
Data Portrayal Time
ep 1 10 am
2003 PDT
-HR Apply Time +HR +3HR
Map Data Layers
Redraw Map
Burn Information
Burn Locations
Burn Traj Hourly Pts
Burn Traj Lines
Def Traj Hourly Pts
Default Traj Lines
Predicted PM2.5
Meteorology
Surface Wind Arrows (Dense)
Surface Wind Arrows (Sparse)
Surface Wind Barbs (Dense)
Surface Wind Barbs (Sparse)
Mixing Height
Vent Index
Relative Humidity
Surface Temperature
Air Emission Sources
Receptors
Census 2000 Data
Census General Summary
Urban Areas
Schools
Hospitals
Specified Date Data for 1 Sep 2003 10:00 PDT
CAUTION: Burn Information Planned, Not actual, Accuracy Unknown
Map Legend
Burn Locations
0 - 100 Acres
100 - 1000 Acres
>1000 Acres
Burn Traj Hourly P
0 2 4 6 8 10
Burn Traj Lines
Predicted PM2.5
5 15 40
Low Mod Hi
Surface Wind Arrow (Dense)
0 < 5 10 15
Wind Speed (m/s
Urban Areas
Major Roads
Interstates
Highways
Redraw Map
Zoom In
Zoom Out
Pan
Full Map
Identify
Links
Sel Rect
Sel Poly
Clear Select
Query
Print
Download

BlueSky

Acknowledgements

- Funding provided by the National Fire Plan
- In-kind funding provided by EPA for development of the RAINS capabilities.
- Thank you to Louisa Evers for promoting BlueSky's use in wildfires across the country and to our FCAMMS partners for making it possible.
- Thank you to the BlueSky developers: Trent Piepho, Lara Kellogg, Sim Larkin, Wes Adkins, Candace Berg, Ray Peterson, Don Matheny, Sue McCarthy, Bob Kotchenruther

Thank You!

Questions?

BlueSky: www.fs.fed.us/bluesky

BlueSky RAINS:
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AirFIRE Team: www.fs.fed.us/pnw/airfire

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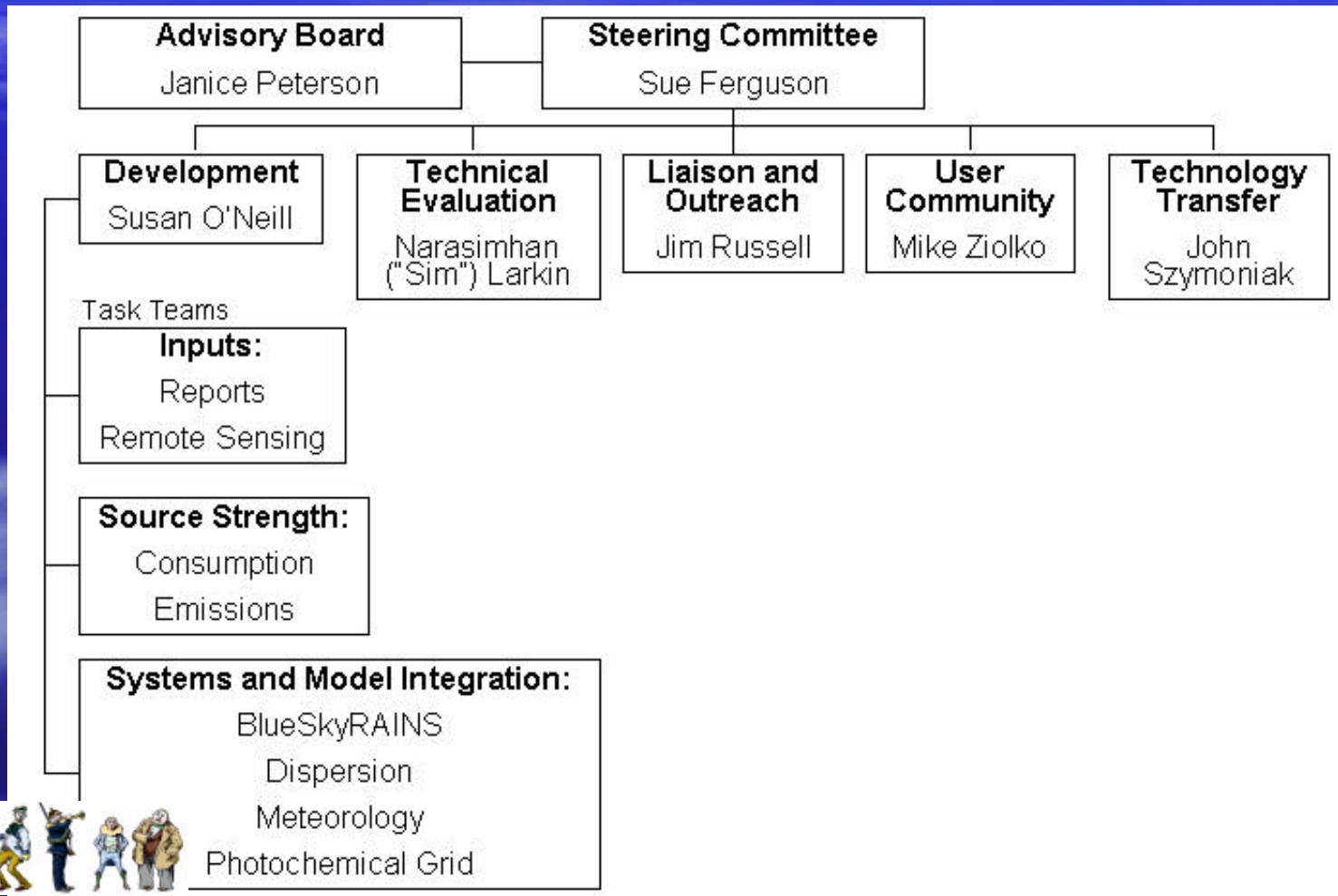
BlueSky Consortium



NorthWest Regional Modeling Consortium (NWRMC)

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